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COUP D' OEIL OR CONFUSION

AN ASSESSMENT OF

THE COMMON OPERATIONAL PICTURE

by

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Preface

I entered this effort with very little knowledge of the Global Command and Control System and virtually no knowledge of the Common Operational Picture. Although a Communications-Information officer by trade, my career has been oriented more on the computer part of C4, and not the traditional GCCS, GCSS, COP, or COE C3 systems and infrastructures. The past six months, however, have provided me with a tremendous opportunity to learn more about command and control, doctrine, and GCCS and COP than I could have imagined. My hope is that I have added at least as much value to the GCCS COP effort as I have received.

I now fully appreciate the other areas of command, control, and communications—those "other" parts of C4—as well as the flip side of the Sun Tzu quote, "*Know your enemy and know yourself*." To know one's self is more than learning the specific knowledge within your own career field or Service—it requires at least a basic understanding of other career fields and Services, as well as how they integrate to form a total force concept. This learning experience, and the opportunity to meet outstanding people from the Air Force, other Services, and other countries, are the aspects of ACSC I have really appreciated.

First and foremost, I would like to thank Lynn, my loving wife, and our wonderful children—Devon, Cheryl, Cara, Cayleigh, and Dylan—for their patience and understanding. I look forward to now being able to spend more time with each of them.

In addition, I would like to thank those people who provided me information and comments to use on this research effort: Mr. Dean Baird, Lt Col Mark Devirgilio, Lt Col Mike Lamb, Lt Col Greg Main, Maj Robert W. “Bull” Lanham, Maj Doug Putney, Maj C. R. Young, and 1Lt Michael Morrill. Without the actual person-in-the-loop—either using or developing the system—the GCCS COP would be nothing.

I would also like to thank Mr. Frank Strickland, the NRO liaison to Air War College, for sponsoring this research effort, and Lt Col Juan Moreno, Air War College Class of 1999, for taking the time to talk with me about his findings.

I would like to extend a special thanks to Lt Col Steve Ornellas, my research advisor, for helping me to keep the important things in perspective throughout this research effort.

Finally, I would like to thank the Lord Jesus Christ for the opportunity to learn and grow during my time as a member of the ACSC Class of 1999.

Abstract

The Common Operational Picture (COP) is an automated command, control, communications, computer, and intelligence (C4I) system providing enhanced viewing of friendly and enemy forces by users of the Global Command and Control System (GCCS). Capabilities include collection of real-time and near-real-time data from multiple sources, data fusion and the capability to present information as a common geographic display.

This research effort looks at history, doctrine, technology, and interview responses, and concludes the GCCS COP is more *coup d' oeil* than confusion, providing a useful capability to commanders in theater. However, as with all emerging systems, there is still much work to be done to fully meet the needs of, and have the system fully used by the warfighter. This paper also presents a GCCS COP "report card," with criteria derived from history and doctrine, for possible use in future evaluations.

Part I of this effort introduces the research effort, problem background, significance, and requirements source. Part II identifies the historical development of command and control systems for theater joint air operations, and develops C4 system assessment criteria from lessons learned. Part III surveys current joint and Air Force doctrine, and develops C4 assessment criteria based on statements in doctrine. Part IV describes the GCCS COP, including capabilities, the Common Tactical Picture (CTP) for component commanders, and challenges that lie ahead. Part V provides an analysis of user/customer interview assessments of the GCCS COP, and an assessment of the COP against

historical and doctrinal criteria for C2 and C4 systems. Finally, Part VI provides overall conclusions and recommendations based on the analysis.

Chapter 1

Introduction

> *Since all information and assumptions are open to doubt, and with chance at work everywhere, the commander continually finds that things are not as he expected… If the mind is to emerge unscathed from this relentless struggle with the unforeseen, two qualities are indispensable:* first, an intellect that, even in the darkest hour, retains some glimmerings of the inner light which leads to truth; and second, the courage to follow this faint light wherever it may lead*. The first of these qualities is described by the French term,* coup d' oeil*; the second is* determination.
>
> —Carl von Clausewitz[1]

The complexities of a changing world, asymmetrical warfare, operations other than war, and the impact of today's high-technology make it extremely difficult for the theater commander-in-chief (CINC) and his staff to handle the possible threats and non-threatening events in his area of responsibility (AOR). In order for the CINC and his commanders to cope with these challenges, and be effective in this ever-changing world of conflict, they must be able to quickly and effectively orient themselves based on the emerging situation.[2] The Global Command and Control System (GCCS) Common Operational Picture (COP) provides information to assist in this orientation. The question is, does the GCCS COP provide enough of the right type of information to be that inner light guiding the CINC and commanders to truth—the *coup d' oeil*—or does it provide too much or confusing information for the CINC and his commanders to have battlefield awareness? This research effort looks at history, doctrine, technology, and interview

responses, and concludes the GCCS COP is more *coup d' oeil* than confusion, providing a useful capability to commanders in theater. However, as with all emerging systems, there is still much work to be done to fully meet the needs of, and have the system fully used by the warfighter. This paper also presents a GCCS COP "report card," with criteria derived from history and doctrine, for possible use in future evaluations.

Background

The quest for battlefield awareness is as old as warfare itself. Mongol "arrow riders" in the 13th century gathered and relayed information to field commanders over distances of many miles.[3] Their efforts gave their commanders battlefield awareness and the edge that enabled them to defeat larger enemy forces.[4] Since then, mechanization in warfare enabled the airplane and three-dimensional warfare.[5] What was once a two dimensional battlefield now became a three dimensional *battlespace*, bringing with it an increase in complexity of operations and thought.

Modern command, control, communications, and computer (C4) systems attempt to be the arrow riders of the current, complex battlespace. However, the more "C"s in the acronym, the more the focus shifts from command, a function of authority and leadership, to communications, computers, and a systems architecture viewpoint.[6] Political considerations (e.g., coalitions) cloud this area even further, influencing both command arrangements and force structures.[7] Another factor for the Air Force is the concept of the Aerospace Expeditionary Force, and it's requirements for a smaller forward operational footprint and information reach-back capability—moving information instead of people—"a key to effective expeditionary air operations."[8] All these point to a need for a

modern day arrow rider that can shoot all the way around the world, from any country to any country, and won't kill the CINC with too many arrows.

Significance

Almost twenty years ago, the *Air Force 2000* report stated the need for development of a rugged and common command, control, communications, computing/information and intelligence (C4I2) capability, with two goals: unity of effort; and effective application of forces against the enemy.[9] Since then, the world picture and the Air Force operational tempo have both dramatically changed. In FY98 alone the Air Force participated in 16 humanitarian aid efforts in 14 countries around the world, and in 56 JCS exercises, and since December 1995 over 4217 total sorties have been flown in the Balkans.[10] Although the operations and locations have changed, there is still a need for the rugged, common C4 capability.

The Information Age and Information Revolution are major factors having global effects, including an information-based Revolution in Military Affairs (RMA) in the military.[11] To put the information explosion into perspective,

> If… you were to read the entire *New York Times* [Sunday edition], you would absorb more information in that one reading than the average person absorbed in a lifetime in Thomas Jefferson's day. Some estimates say that the total amount of information in the world is now doubling every 18 months.[12]

This RMA was first seen in the Gulf War; and may be an indication of an order of magnitude increase in military capability not experienced since the German *blitzkrieg* of WWII.[13] However, time is short—indications show the Information Age may only be about 50 years long, and we might already be halfway through it.[14]

The US is not the only country realizing the opportunity to capitalize on the amount and type of information that will be available in theater. Others, such as the defense intellectuals in China and the military theorists in Russia, are also aware of the impact of information technologies on war.[15] Clearly, the US must proceed with its own technical and information-oriented efforts. One such effort is digitization of the battlefield—using an integrated digital information network to support warfighting systems and provide the warfighter command and control decision-cycle superiority.[16] Another is the GCCS.

The primary function of GCCS is to provide C2 to the warfighter, making additional capabilities to help intelligence planners.[17] Installed in over 700 worldwide locations, GCCS provides capabilities including weather forecasting, collaborative planning, and improved JOPES handling tools.[18] Providing a fused picture of the battlespace GCCS also promises to reduce the large number of systems deployed and in use today.[19] GCCS appears to be trying for the position of "arrow rider" for the 21st century, even more with the advent of the Common Operational Picture (COP). The COP addresses theater-level situational awareness, and can easily be the foundation for other RMA concepts, including the Theater-Level Integrated Sensor-to-Shooter Capability, and improved reporting and use of battlefield damage assessment (BDA).[20]

Requirements Source

The requirement for a system such as the GCCS originates in the National Security Strategy (NSS), which states,

> Our priority is to shape effectively the international environment so as to deter the onset of major theater wars. Should deterrence fail, however, the United States will defend itself, its allies, and partners with all means necessary.[21]

This position is embodied in the National Military Strategy's (NMS) Shape, Respond, and Prepare Now. One area where the NMS takes this further is with Strategic Agility—specifically stating the need to orchestrate, command, control, and support dispersed joint warfighting forces.[22] Additionally, JV 2010 describes "an uninterrupted flow of information" necessary for information superiority, and to mitigate the friction and fog found in both war and peace operations.[23] The command and control aspect of the NMS and the information flow aspect from JV 2010 come together in the Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 6212.01A. This document identifies the C4I For The Warrior (C4IFTW) concept, with its ultimate goal of providing,

> … a DOD-wide, global, secure C4I infrastructure that will accommodate the widest possible range of missions and operational scenarios by allowing users to enter the infrastructure anytime and anyplace in the execution of any mission…that satisfies the requirements of the warfighter.[24]

Or, stated as a requirement in even more concise terms,

> What the Warrior needs: a fused, real-time, true picture of the battlespace—an ability to order, respond and coordinate horizontally and vertically to the degree necessary to prosecute his mission in that battlespace.[25]

Therefore, meeting this requirement enables the warfighter to have superior situational awareness, and the ability to shape the battlespace—both in support of National Strategy.

Overview

Part II of this paper identifies the historical development of command and control systems for theater joint air operations, and develops C4 system assessment criteria from lessons learned. Part III surveys current joint and Air Force doctrine, and develops C4 assessment criteria based on statements in doctrine. Part IV describes the GCCS COP,

including capabilities, the Common Tactical Picture (CTP) for component commanders, and challenges that lie ahead. Part V provides an analysis of user/customer interview assessments of the GCCS COP, and an assessment of the COP against historical and doctrinal criteria for C2 and C4 systems. Finally, Part VI provides overall conclusions and recommendations based on the analysis.

Limitations

The scope of this research effort focused only on the COP portion of the GCCS.

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Chapter 2

Lessons from History

> *From Plato to NATO, the history of command in war consists essentially of an endless quest for certainty—certainty about the state and intentions of the enemy's forces; certainty about the manifold factors that together constitute the environment in which the war is fought, from the weather and the terrain to radioactivity and the presence of chemical warfare agents; and, last but definitely not least, certainty about the state, intentions, and activities of one's own forces.*
>
> —van Creveld in *Command in War*[1]

The history of command and control in air warfare contains insights into the foundational concepts critical to the C2 system needed for today's Joint Air Operations. This chapter evaluates major joint air operations of the past to identify proposed historical-based criteria for assessing the GCCS COP.

WWI and WWII

In WWI the St. Mihiel "salient"—or bulge—was a result of Germany's unsuccessful attempt to encircle the fortress of Verdun in 1914.[2] Four years later, in 1918 during the American offensive against St. Mihiel, Col. William "Billy" Mitchell, then Chief of the American 1st Army Air Service, assembled almost 1500 Allied aircraft to support the ground operations, providing unity of command through his personal development and orchestration of the plan.[3] Further, he was able to maintain both a theater-wide view of the battlefield and good communications.[4] Col. Mitchell's efforts resulted in centralized

control of the largest combined Allied air force of WWI, and in mass and unity of effort of air operations directly supporting the forces in the St. Mihiel offensive.[5]

Almost a quarter of a century later, the Battle of Midway was the first major joint combat air operation involving the Navy, Marine Corps, and Army Air Force (AAF).[6] Admiral Nimitz, the Pacific Fleet Commander, had battlefield awareness, knowing the location of both his carrier and land-based forces and also the Japanese forces through the efforts of patrol planes. Unfortunately, his ambush strategy and radio silence prevented his component commanders from having the same picture. A coordinated air strike could have brought mass against the Japanese fleet early in the battle; however, the lack of communications between the joint Midway air forces and the carrier task forces hindered this, with unity of effort eventually being achieved by accident.[7]

From 1942 to 1944 the Solomons Campaign saw a much better integration of joint forces (including Royal New Zealand Air Force Units), with COMAIRSOLS providing unity of command, maintaining battlefield awareness, and having good communications—all a result of initially using a single Service's chain of command:

> Air Force units were placed under Navy and Marine Corps commanders...When an Air Force officer did succeed to command [MGen Twining on 15 Jul 1943], the system was already functioning with a joint staff; Navy and Marine unit commanders had no difficulty accepting his tasking orders.[8]

Based on this, the Solomons Campaign has been considered "the high-water mark of jointness and unity of effort in air operations until the Persian Gulf War in 1991."[9]

Korea and Vietnam

After WWII, the disagreement between the Navy and newly formed Air Force resulted in a loose integration of land and sea-based tactical air forces in Korea.[10] Lack of

unity of command resulted in the Air Force having *coordination control* of joint air efforts, yet without command authority for requirements, tasking, and direction of air operations.[11] Since, unlike WWII, national survival was not at stake, unity of effort was lost in doctrinal arguments.[12] In an effort to help coordinate theater air and ground operations, a Joint Operations Center (JOC) was established in July 1950.[13] Even so, the view of the battlefield was not always clear—target intelligence practically did not exist during the initial weeks of the war, and efforts to locate and bomb moving enemy troops could result in casualties to both friendly forces and fleeing refugees.[14] Joint air operations almost died early in the conflict due to difficulties with communications capacity, procedures, and doctrine.[15] The lessons from WWII were forgotten.

In contrast, Vietnam saw improvements in interoperability and communications; however, due to politics, command and control problems still existed that were beyond the ability of the joint commanders to solve, making unity of effort for joint air operations an elusive and even ignored goal.[16] Technology improvements may have been a contributing factor to the C2 problems. Advances in communications and automated data processing equipment made worldwide command and control from Washington a reality.[17] This, in turn, resulted in the possibility of "reach back" C2 of tactical objectives—for example, President Johnson and his advisers selecting the bombing targets for Rolling Thunder at "Tuesday White House Luncheons" attended by NSC principals, but not the military.[18] The lesson here is that even if technology allows, the theater commander must have unity of command without someone outside the theater giving him tactical direction.

The Gulf War

Considered the first modern "information war," military operations in the Gulf War relied on information from many sensors and systems at all echelons.[19] Unity of command for the joint air operations was due in a large part to the US C2 system—it enabled General Horner to design and implement the air campaign plan, and also played a critical role in facilitating coalition operational capability.[20] However, arriving US forces had to build and install the C3I system in theater from scratch.[21] This drove a reliance on STU-III and commercial communications systems that lasted throughout the war, causing compatibility problems for the UHF-oriented Navy.[22] Also, commercial communications allowed intermediate theater-level organizations to be bypassed (e.g., going direct to Washington), resulting in confusion.[23] At times the view of the battlefield was incomplete, since accurate BDA was difficult to obtain.[24] In summary,

> On the whole, the Coalition had not automated the extremely complicated tasks of developing force packages and air tasking orders and monitoring bomb damage nearly as much as those who speak of a military technical revolution would expect.[25]

Somalia

Unity of command is just as much a challenge in peace operations as it is during war. In multinational peacekeeping operations, such as Somalia, unity of command must take into account the existence of parallel lines of authority, and even more so when the mission requires combat.[26] Intelligence is just as vital to allowing the peace-keeping operations commander to see the "battlefield" (friendly and enemy forces) as the warrior.[27] Good communications is just as essential in peace operations, possibly more so, due to the difficulties imposed by the command and control arrangements; however,

the more diverse the coalition forces involved, the more diverse the communications capabilities and the challenge to manage them.[28] One other lesson was to minimize the different types of systems in theater, improving both operations and logistics. For example, during *Restore Hope* there were over 10 different data systems performing common functions (e.g., intelligence, logistics, personnel, finance)—most were built to meet a single service's requirements, had their own logistics infrastructure, and required their own different slice of the already tight communications resources.[29] Therefore, the C2 lessons learned from peace operations in Somalia verified that what we need in war, we also need in peace operations.

The Balkans Air Campaign

In the Balkans Air Campaign, unity of command was based on ownership and familiarity of the C4 systems in theater. As in previous operations, at the start there was a need to modernize communications and intelligence data terminals (e.g., the Combat Air Operations Center (CAOC)), and provide connectivity to AIRSOUTH, and squadrons and field units in theater (e.g., NATO field units and squadrons deploying in Italy).[30] Although the C4 networks were primarily US in both technology and doctrine, they proved important to the overall coalition airpower effort; however, because they were US, several NATO allies reluctantly conceded that "he who's ready to control…will command."[31] With unity of command and communications established, battlespace awareness and sharing of information were still issues. As in the Gulf War, intelligence was important for two reasons: intelligence, including BDA, is necessary to exploit airpower's capabilities; and the reluctance and suspicions of coalition partners in sharing intelligence threatened to disrupt unity of effort.[32] Therefore, establishing the mostly US

communication and computer networks was important to this operation for both unity of command and communications. Unity of effort, however, was threatened by failure to share the battlespace view with coalition members.

Summary and Conclusions

While much of the technology has changed since WWI, three fundamental criteria appear to be factors for air operations to effectively achieve both unity of effort and mass: unity of command in the command and control structure; the ability of the commander to see the battlefield (e.g., know your own and enemy forces); and good communications in place to facilitate command and control. As seen from history, unity of effort can not be fully attained without unity of command. Also, unity of effort can be threatened by limiting the sharing of battlefield information in a coalition campaign. Therefore, enabling unity of effort should be the objective of any C2 system.[33] The joint air operations C2 system and its, C4 underpinnings, must meet this objective by facilitating unity of command.

The commander's battlefield awareness and ability to communicate intent in a timely manner are important to achieving both unity of effort and mass. Therefore, the joint air operations C2 system must provide battlefield—or including the dimension of space, battlespace—awareness of all forces in theater: friendly, enemy, peacekeeping, and even non-governmental and private voluntary organizations. The C2 system must also include a robust communications capability as past of the C4 infrastructure. The "Achilles' heel" of military operations, the communications infrastructure and capability must therefore either already be in place or be readily deployable to the theater—either way, the warfighters must have proper and adequate training and doctrine.[34]

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Chapter 3

C2 and C4 Doctrine

> *Doctrine provides a military organization with a common philosophy, a common language, a common purpose, and a unity of effort.*
>
> — General George H. Decker, USA[1]

Doctrine is an important source of guidance for development of both C2 and C4 systems. Doctrine provides a distillation of insights and wisdom from the Services' collective experience in both war and operations other than war.[2] It also effectively documents desired C2 and C4 system characteristics, which is then useful for analyzing the effectiveness of new and emerging systems. This chapter surveys current C2 and C4 doctrine to identify proposed doctrine-based criteria for assessing the GCCS COP.

Doctrine for C2 Systems

Applied to doctrine, General Decker's statement provides a good roadmap to define aspects of a C2 system. First, the *common philosophy* of C2 systems is based on C2 systems needing to support the commander in both current operations and planning for future operations.[3] These concepts of *operations support* and *planning support* apply equally to the JFACC, who must have a "capability to plan, task, and control joint air operations."[4] Air Force doctrine affirms this, declaring C2 as both a decision process and the system carrying out that process.[5] Air Force doctrine also considers the C2 system a

"reflection of the airpower tenet of centralized control and decentralized execution"[6] Air Force doctrine further defines an Airspace Control System, with fundamentals such as common airspace control procedures, and durable, flexible, and redundant systems.[7] Therefore, these views indicate a need for the C2 system to provide necessary operations support and planning support to the commander.

The second aspect is *common language*, which is realized in the connectivity between systems (e.g., *interoperability*), and between the user and the system (e.g., *user interface*). System communications, and hence connectivity, must be reliable, secure, and interoperable.[8] Connectivity of the JFC, joint force staff, and component commanders facilitates the functional support mentioned above, and is considered the key to successful integration of the joint air effort.[9] Again, Air Force doctrine supports this, stating the requirement for communication systems and procedures to be interoperable and compatible among all managers and users of the airspace.[10] However, outside of JP 6-0, Joint doctrine does not mention the interface between the user and the system—it does, though, mention CTAPS as a system example.[11] This void concerning user interface and presentation is better addressed by the Air Force in its Airspace Control System fundamental of simplicity, which emphasizes the need for system usability

> Airspace control structure and procedures need to be simple to execute for both ground operations personnel and aircrews. It should include visual, electronic, geographic, and maneuver means for sorting friendly and enemy aircraft.[12]

The *common purpose* implies both an organizational and informational perspective. Organizationally, this means enabling *unified action*—the ability to integrate different organizations and their activities into an effective force, with units and systems from any or all of the Services operating together effectively.[13] Multinational, interagency, private

voluntary organizations, and non-governmental organizations should also be considered.[14] From an information viewpoint, common purpose means enabling *information fusion*—bringing together different information into an effective common picture. The information presented must be accurate and usable, and there must not be so much as to overwhelm the user.[15] Information fusion would enable combat assessment, including BDA and munitions effects assessment (MEA), permitting faster re-attack recommendations.[16] It would also provide the commander a way to conduct overall C2 faster than potential adversaries, resulting in a substantial strategic advantage.[17]

Finally, *unity of effort* is the fundamental aspect of joint warfare, derived from the principles of war.[18] Discussed throughout the various doctrine publications, it was also addressed in the historical assessment of this paper, and will not be further covered here. Taken together, these four—*common philosophy, common language, unified action, unity of effort*—form a criteria framework useful in assessing new or emerging C4 systems. The next section will investigate possible criteria for that framework.

C4 Systems Doctrine

Joint doctrine identifies both the mission and the JFC's C2 organization as the basis for development of theater C4 systems.[19] In support of this concept, basic doctrine for C4 systems identifies several requirements, including the ability to ensure continuous information access and exchange through a rapid, reliable, and secure flow and processing of data.[20] C4 systems must also provide information and decision support capability to the JFC and staff.[21] While these requirements are important, more specific criteria are needed to evaluate proposed C4 systems.

Joint Publication 6-0 identifies four fundamental objectives of C4 systems, seven C4 principles, and seven information quality criteria. However, there is no current Air Force doctrine concerning C4 systems. The available doctrine can be mapped into the categories identified above, resulting in a proposed assessment framework with specific criteria shown in Table 2. Grouping and placement of the criteria is understandable given the framework, with the possible exception of "disciplined" under the category of *unified action*. The decision to place it in that category was made based on both the causal relationship between the C2 structure and the resulting C4 supporting structure, and the resource management the JFC staff must use to stand up the C4 system. Also, several of the criteria could easily span multiple categories, and the level of detail is not all-encompassing. However, this summary of doctrinal objectives, principles and criteria, though rudimentary, should provide an effective means to assess the GCCS COP.

Summary and Conclusions

User and system requirements are identified throughout various doctrine documents, making it difficult to fully understand what is needed in a complete C4 system. Integrating the available information into a single, easy to use format facilitates assessment of new and emerging C4 systems against doctrine-based user requirements. In this case, all of the C4 specific requirements were drawn from a single Joint publication. It is unfortunate that while the Air Force has developed operational doctrine concerning three of four major system models—operational air tasks, functions, and organization—it has not yet established operational doctrine addressing the all important C4 systems architecture.[22]

Table 1. Proposed Doctrine-Based Assessment Framework and Criteria

Common Philosophy	**Common Language**
Operations Support	*Interoperability*
Exploit Total Force Capabilities (O)[a]	Interoperable (P)
Flexible (P)[b]	
Responsive (P)	*User Interface*
Mobile (P)	Properly Position Critical Information (O)
Survivable (P)	Usability (I)
Sustainable (P)	Brevity (I)
Accuracy (I)[c]	
Relevance (I)	
Timeliness (I)	
Completeness (I)	
Security (I)	**Common Purpose**
	Unified Action
Planning Support	Disciplined (P)
Exploit Total Force Capabilities (O)a	
Flexible (P)	*Information Fusion*
Responsive (P)	Information Fusion (O)
Mobile (P)	
Survivable (P)	
Sustainable (P)	
Accuracy (I)[c]	
Relevance (I)	**Unity of Effort**
Timeliness (I)	Produce Unity of Effort (O)
Completeness (I)	
Security (I)	

Sources: Joint Pub 6-0, *Doctrine for Command, Control, Communications, and Computers (C4) Systems Support to Joint Operations* (30 May 1995); Air Force Doctrine Document (AFDD) 2-1.7, *Control in the Combat Zone*, June 1998; and the author's proposed framework for assessment.

[a] C4 Systems Objectives
[b] C4 Principles
[c] Information Quality Criteria

Notes

[1] Quoted in *Joint Doctrine Encyclopedia*, 16 July 1997, 253.

[2] *Joint Doctrine Encyclopedia*, 16 July 1997, 254.

[3] Joint Pub 3-0, *Doctrine for Joint Operations*, 1 February 1995, II-16.

[4] Joint Pub 3-56.1, *Command and Control for Joint Air Operations*, 14 November 1994, II-2.

[5] Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine*, September 1997, 53-54.

Notes

[6] Air Force Doctrine Document (AFDD) 2-1.7, *Control in the Combat Zone*, June 1998, 31.

[7] AFDD 2-1.7, 4.

[8] Joint Pub 3-0, *Doctrine for Joint Operations*, 1 February 1995, II-16.

[9] Joint Pub 3-56.1, *Command and Control for Joint Air Operations*, 14 November 1994, IV-12.

[10] AFDD 2-1.7, 4.

[11] Joint Pub 3-56.1, IV-12.

[12] AFDD 2-1.7, 4.

[13] Joint Pub 0-2, *Unified Action Armed Forces (UNAAF)*, 24 February 1995, I-8.

[14] Joint Pub 0-2, viii.

[15] AFDD 1, 32.

[16] Joint Pub 3-56.1, IV-11.

[17] AFDD 1, 32.

[18] Joint Pub 1, *Joint Warfare of the Armed Forces of the United States*, 10 January 1995, viii.

[19] Joint Pub 6-02, *Joint Doctrine for Employment of Operational/Tactical Command, Control, Communications, and Computer Systems*, 1 October 1996, v.

[20] Joint Pub 6-0, *Doctrine for Command, Control, Communications, and Computers (C4) Systems Support to Joint Operations*, 30 May 1995, I-7.

[21] Joint Pub 6-0, vii.

[22] Lt Col James M. Liepman, Jr., "C(nth)I(nth)xyz, TACS, and Air Battle Management: The Search for Operational Doctrine" (Naval War College, Newport, RI, June 1997), 19.

Chapter 4

The Common Operational Picture

Far from determining the essence of command, then, communications and information processing technology merely constitutes one part of the general environment in which command operates.

— van Creveld in *Command in War* [1]

Overview

The Common Operational Picture (COP) is one of the most important parts of the warfighting CINC's general command environment. The COP provides the CINC a theater-specific, integrated, graphical depiction of the battlespace. The COP is also capable of providing access to common data and information at all levels of command, from the subordinate commanders in theater up to, and including, the National Command Authorities (NCA).[2] Within the AOR, the CINC has overall control of both data and information overlays, and uses the Common Tactical Picture (CTP) from the component commanders as a baseline to create the theater level COP.[3] Every CINC and AOR are different. Each CINC must therefore establish overall data and information reporting requirements for component commanders and staffs, in order to ensure that proper data and information are provided to form the theater-specific COP (see Figure 1).[4]

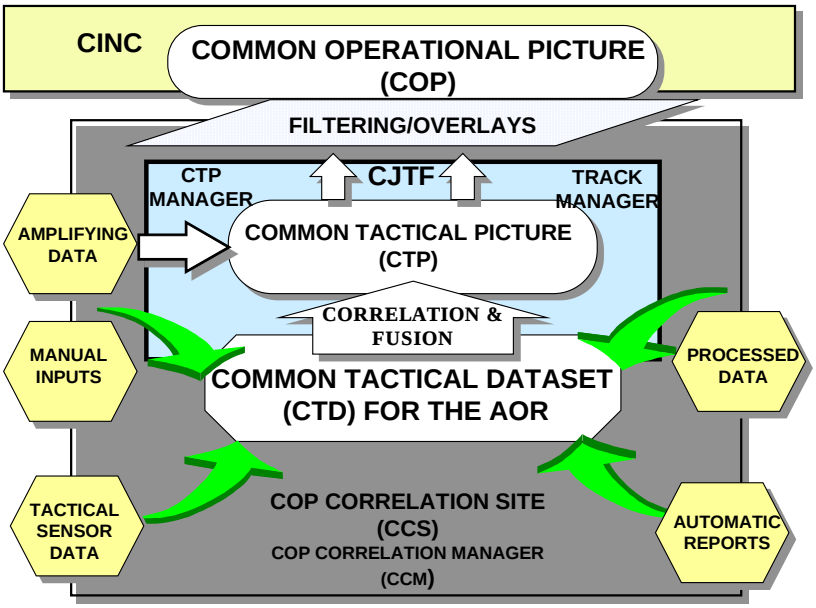

Figure 1. Creating The Common Operational Picture (COP)

(From *Global Command and Control System (GCCS) Common Operational Picture (COP) Handbook for GCCS 3.02*, Version 2.0, 31 July 1998, 1-9)

Capabilities

The COP relies on both applications software and COE Support and Infrastructure Layer Services to accomplish its functions.[5] It is actually composed of two parts: the *operational* picture, and the *common* picture.[6] The operational picture is a CINC-level view of the battlespace, developed from the aggregate tactical pictures (from component commanders), theater plans, commander's intent, resources available, and other theater-specific information.[7] The other part, the common picture, is a view of the battlespace shared throughout the theater, and is derived from collective access to data regardless of command level or geographic location.[8] Integrated together, they provide all commanders in theater a multi-level, tailorable, common view of the battlespace based on a single, sharable set of data and information.

Using primarily a graphical display format, the COP provides current location, status, and (if available) planned movement of friendly, neutral, and enemy ground, maritime, and air units.[9] COP can also display additional information (e.g., weather and Battle Damage Assessment (BDA)), including user-defined projections (e.g., battle plans, operating zones, and fly-through depictions).[10] The following categories further explain these capabilities:

Display. The COP can make use of many National Imagery and Mapping Agency (NIMA) Cartographic Products as backgrounds for displays.[11] COP can also provide track display and management, using different symbols and colors to differentiate each track.[12] Figure 2 is an example of an output of the CHART capability that provides this.

ATO. The COP can also utilize ATO information to provide planning, and air mission monitoring, as its underlying system (GCCS) is capable of receiving and sending the ATO.[13]

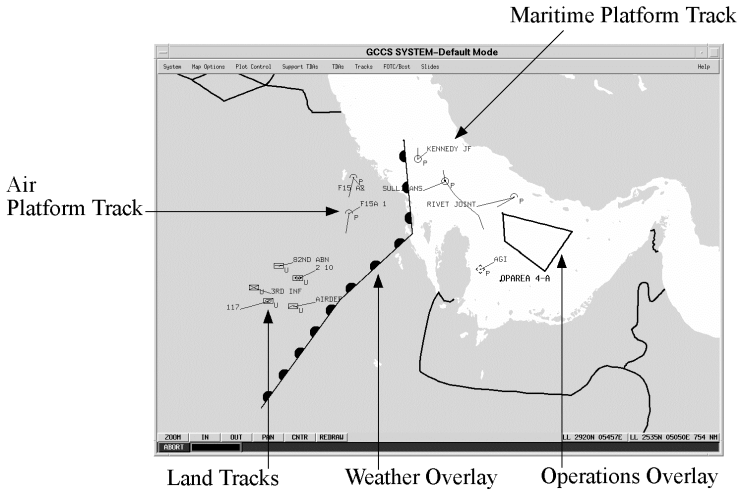

Figure 2. Example CHART Display

(From *Global Command and Control System (GCCS) Common Operational Picture (COP) Handbook for GCCS 3.02*, Version 2.0, 31 July 1998, 1-3)

Support Capabilities. The COP provides inherent and user-definable support capabilities, such as: displaying operating zones; performing and facilitating track management, track correlation and analysis; providing input/output communication filters, display filters, and plot controls; line-of-sight computation and display.[14]

Intelligence and Imagery. The COP accesses appropriate intelligence and imagery databases.[15] This capability will become even more significant in the future, as the imaging world is migrating to a "multi-int" concept, going from stove-piped collection and reporting systems to a joint system internetted together—all with the goal of reducing the time for getting information to the shooter.[16]

Theater Ballistic Missile Defense. COP supports this with both alerting and tracking capabilities.[17]

Common Tactical Picture

A subset of the common picture described above, the CTP is a fundamental component in building the COP.[18] The general paradigm for operations has the CINC using the COP for theater level situational awareness, while a subordinate commander (e.g, a JFACC or JTF Commander) uses CTP for command and control.[19] In support of this, the primary tactical data elements of track, sites, and overlays, can either be manually inserted done through automated means.[20] These tactical data elements are then capable of being transmitted or broadcast to other personnel having access to the theater COP architecture.[21] Of interest is the Tactical Digital Information Link (TADIL) or Link network, which provide the *tactical* air picture for the CTP.[22] This information, in turn, is available in theater for integration into the COP.

Challenges

The current COP is far from the 3-D view one sees in science fiction movies. One of the most challenging aspects in fully realizing the COP is that component commanders often use systems and databases outside of COP in the performance of their jobs (e.g., for specialized analysis).[23] Leery of new technology, those commanders desire their own existing direct data feed not connected to (or corrupted by) the COP, because they trust that data more.[24] Having separate systems, however, also excludes important data from use as part of the sharable data set. Therefore, the biggest technical challenge will be establishing all the data sources required by the CINC and developing the COP architecture to support this—followed by keeping the system up and running.[25]

Maintenance of the CTP and following reporting procedures is another challenge. COP accuracy and effectiveness can be severely impacted if CTP upkeep and reporting becomes a lower priority to the component commanders.[26] While the overall COP would be affected, a potentially worse situation could result as the different local CTP pictures begin to diverge from each other.[27]

Joint Staff Common Operational Picture (COP) Working Group (COPWG) is addressing these and other issues, including: the ability for GCCS COP to accept all-source, real-time multi-format track feeds; improve data displays; provide better filtering capability; provide better support for force planning and execution; and improve LAN and WAN interface/interoperability.[28] All this in an effort to reach the ultimate goal of fully integrated information, providing "Any User, Any Box, Anywhere, One Picture!"[29]

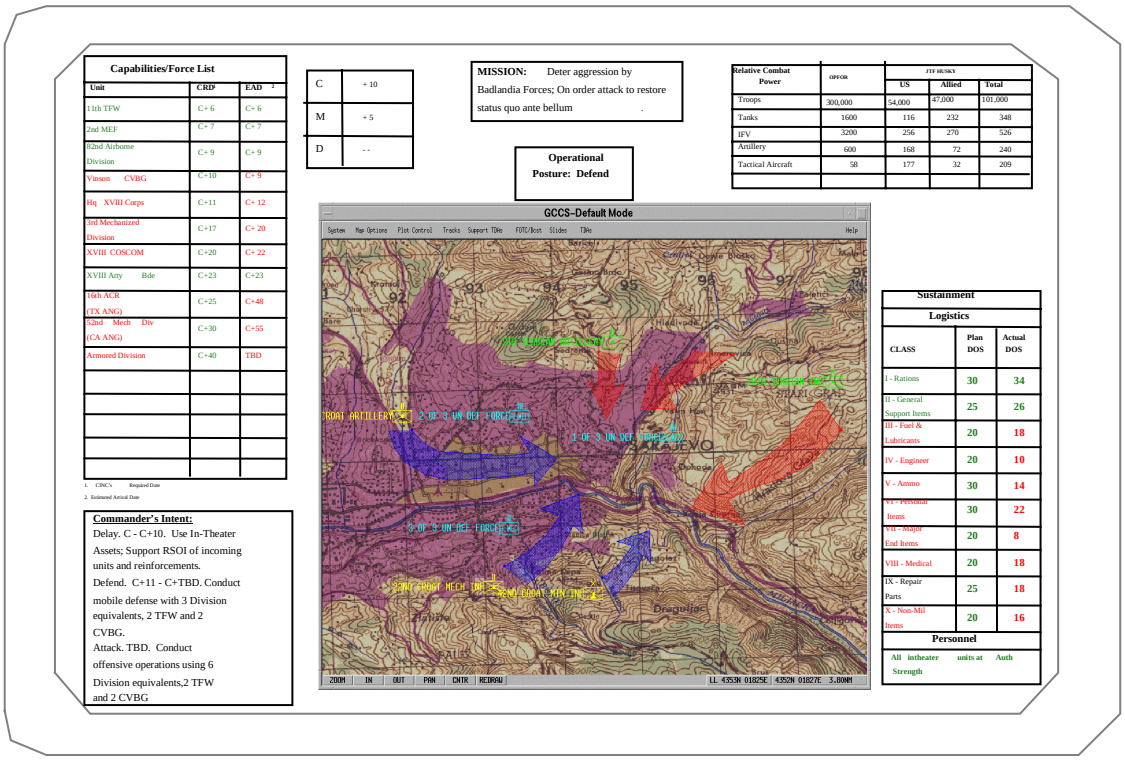

Figure 3. "The Goal: Fully Integrated Information"

(From Dr. Frank Perry, "Achieving Information Superiority," slides from keynote address at 1998 AFCEA/SPAWARSYSCEN Joint C4ISR Symposium: Information Superiority for Joint Vision 2010; on-line, Internet, 20 March 1999, available from http://www.afcea-sd.org/c4isr/1998/docs.html)

Notes

[1] Martin van Creveld, *Command in War* (Cambridge, MA: Harvard University Press, 1985), 275.

[2] *Global Command and Control System (GCCS) Common Operational Picture (COP) Handbook for GCCS 3.02*, Version 2.0, 31 July 1998, 1-8.

[3] *Global Command and Control System (GCCS)*, 1-8.

[4] *Global Command and Control System (GCCS)*, 1-8.

[5] Inter-National Research Institute, "Defense Information Infrastructure (DII) Common Operating Environment (COE) Common Operational Picture (COP) Technical Requirements Specification (TRS)," Technical Requirements Specification (Reston, VA: Defense Information Systems Agency, 4 December 1998), 3.

Notes

[6] Inter-National Research Institute, 3.
[7] Inter-National Research Institute, 6.
[8] Inter-National Research Institute, 7.
[9] *Global Command and Control System (GCCS)*, 1-2.
[10] *Global Command and Control System (GCCS)*, 1-2.
[11] *Global Command and Control System (GCCS)*, 1-6.
[12] *Global Command and Control System (GCCS)*, 2-4.
[13] *Global Command and Control System (GCCS)*, 5-11.
[14] *Global Command and Control System (GCCS)*, 1-7.
[15] *Global Command and Control System (GCCS)*, 1-7.
[16] Mr. Ken Lindsey, "Future of U.S. Airborne Reconnaissance," slides from presentation at *1998 AFCEA/SPAWARSYSCEN Joint C4ISR Symposium: Information Superiority for Joint Vision 2010*; on-line, Internet, 20 March 1999, available from http://www.afcea-sd.org/c4isr/1998/docs.html
[17] *Global Command and Control System (GCCS)*, 1-8.
[18] Inter-National Research Institute, 7.
[19] *Commander's Common Tactical Picture Guide for GCCS 3.02, Draft Version 1.0*, 10 August 1998, 1.
[20] *Commander's Common Tactical Picture Guide*, 2.
[21] *Commander's Common Tactical Picture Guide*, 2.
[22] *Commander's Common Tactical Picture Guide*, 29.
[23] Inter-National Research Institute, 9.
[24] Inter-National Research Institute, 9.
[25] Lt Col Greg Main, ESC/DIAC COP Program Manager, interviewed by author via email, 1 February 1999.
[26] Inter-National Research Institute, 9.
[27] Inter-National Research Institute, 9.
[28] GCCS Common Operational Picture Working Group (COPWG), Memorandum for GCC Review and Advisory Boards, subject: GCCS COP Functional Capability Requirements, 14 April 1997; on-line, Internet, 16 February 1999, available from http://dii-sw.ncr.disa.mil/coe/wg/cop/docs/memos/copreqs.shtml
[29] Dr. Frank Perry, "Achieving Information Superiority," slides from keynote address at *1998 AFCEA/SPAWARSYSCEN Joint C4ISR Symposium: Information Superiority for Joint Vision 2010*; on-line, Internet, 20 March 1999, available from http://www.afcea-sd.org/c4isr/1998/docs.html

Chapter 5

Analysis

> *I'm proud to say that during a year and a half at Vicenza, I only keyed the microphone once.*
>
> —Major General Timothy A. Kinnan[1]
> *Commenting on the "CAOC-to-Cockpit"*

To properly assess the adequacy and effectiveness of the GCCS COP system, two methods of collecting information were used. The first method was an email-based interview and correspondence with customers and users of the GCCS COP, program office personnel, and other interested personnel having experience with the system. The second method was to identify other documented comments. Results of the first method are in Appendix A and analyzed below. The second method yielded only two sources of information—the available literature addresses the basic GCCS, with no mention of the COP. These results are in Appendix B, and were used in the mapping discussed below.

All collected information was then mapped against an integration of the historical criteria from Chapter 2 and the doctrine-based criteria from Chapter 3.

Interview Results and Analysis

A series of seven interview questions were sent to potential respondents. The questions addressed four specific areas: the individual's background and experience with the GCCS COP; the type, amount, and filtering of information provided by the COP;

issues in fielding the system; and the relationship between doctrine and the COP. A total of seven personnel were interviewed. However, not all respondents answered all the questions. Those questions the respondents thought were outside their area of expertise or experience were not answered.

A parallel effort at Air War College to assess the usefulness of the COP yielded a second set of interview questions and responses. From these, one set of responses addressed areas similar to those identified above. Those questions and applicable responses are also included in Appendix A, and are incorporated into the summary and analysis in this chapter. The following paragraphs contain the summary results by area.

Respondent Background and Experience

Personnel interviewed represented a wide range of involvement with the system (see Table 3). They also represented diverse organizations: Air Combat Command, the Joint Staff J3, Navy SPAWAR, Electronic Systems Center, and the Air Force Doctrine Center. The three most knowledgeable personnel had some sort of operational use experience, with two of those three having additional experience in either the program office or as a system developer. The least experienced person had recently received a three-week course, and does not use the system on a day-to-day basis. While respondents to this interview did not include representation of the three main COP users (EUCOM, CENTCOM and PACOM), comments from the parallel interview effort were from a knowledgeable system user in EUCOM. Therefore, the diversity of experience, background, and organizational representation was sufficient to permit an assessment of the system.

Table 2. Demographics of Personnel Interviewed

Experience	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6	Person 7	Person 8[a]
User – Experienced	X							X
User – Limited		X	X		X	X		
Policy & Requirements							X	
Program Management			X					
Developer/ Engineer		X						
System Fielding			X					
Technical Reviewer/ Engineer				X				
Doctrine Development	X			X				

[a] Respondent to Parallel Interview Effort

Comments on Information Provided by the COP

Three different questions were asked concerning COP information, each focusing on a different aspect. Interview responses to these questions demonstrated a wide range of opinion, indicative of the diverse nature of both the customer and the system.

Does the system present the right information needed by the users? Two of the seven personnel interviewed thought the system provided the right information, one qualifying this statement based on current system design constraints, and the other stating their view was based on the training course taken. Two other respondents indicated the system did not provide the right information, one citing a lack of useful data due to system incompatibilities (e.g., battle damage assessment information), the other

indicating the system is more a systems engineering experiment than a tool. The final three personnel acknowledged that although the present system is useful, it needs improvement to meet user needs. The respondent to the parallel interview also thought the COP presented the right information, citing its usefulness in: situational awareness; theater ballistic missile warning; and in plotting the ATO and verifying aircraft during execution.[2]

Therefore, while the GCCS COP might not be capable of presenting all the right information, it does currently provide useful information, and still has some work to be done in this area.

Are system users presented with too much information, just enough information, not enough information? Six people responded to this question. Three stated the system provides too much information. One person qualified this, stating that because information needs and fusing abilities differ from person to person, too much information was a desirable goal at this point in the system's development,

> The question is, how much do you fuse purely through automation prior to display? Until this is defined, we choose to error on the conservative side of providing too much information, allowing the customer to decide how to fuse.[3]

The other three believed the system could present users with the correct level of information based on both filtering and other factors, such as doctrine and a CONOPS. One person offered that while the present quantity of COP data could be improved, a more accurate measure would be the *quality* of the information—an attribute which would also address both timeliness and "integration/correlation/fusion of similar info from different sources."[4]

In summary, the GCCS COP currently can provide too much information to the user, especially at the tactical levels. However, use of filtering and other factors (e.g., doctrine and CONOPS), can help display the right amount of information.

What filters are available to enable the user to customize the type/amount of information that can be presented for decision making? Five people responded to this question, all mentioning that filtering was available. Three respondents mentioned filters existed for both communications (incoming data) and display data (tracks). One of the personnel interviewed described the filters themselves as being "pretty flexible," and overall the current system filtering capability is good.[5]

Comments on Issues in Fielding the System

Five people responded to this question. All five indicated there were issues in fielding the GCCS COP. Responses ranged from, "Need a 'mission ready' training program to be sure all users in the field are fully capable,"[6] to

> I don't think the users really know what they need or want. Thus the issues are minor as the system is used in a "test drive" mode. Real ops will be the ultimate test. [7]

Three people identified training as important, and two stated COP data reporting requirements (e.g., information concerning aircraft and airbases) were an issue. Almost all acknowledged the current state of training, doctrine, and CONOPS for each of the Services differs dramatically. This difference is also echoed in the printed literature,

> All services agree to the requirement for a joint common operational picture to support theater planning and operations, but few agree on the specific display information and applications necessary to perform the missions."[8]

One other important issue is to the need for the theater CINC to allow Service components access to the COP for "preparing forces to deploy in contingencies," where

"deploying units need access to the COP to gain situational awareness."[9] This underscores the fact that the system is still maturing, and there are still access issues and procedures that need to be addressed.

Comments on the Relationship Between Doctrine and the COP

Responses demonstrated a wide range of views. One side pointed out how doctrine has always lagged technology,[10] with technology actually causing weak C2 doctrine.[11] In contrast, the other side commented that current C4I doctrine "is flexible enough to accommodate the changes in technology," and while technology is ever changing, "the C4I For The Warrior vision remains the same."[12] This points out the challenges of meeting the requirements of two parallel tracks of doctrine—one addressing command and control functions, the another addressing the C4I system to facilitate those C2 functions. One person stated it this way,

> COP supports this [C4I] doctrine, perhaps not perfectly yet, by graphically displaying various types of intel and operational data on one screen. I'm sure WWII commanders dreamed of 'battlespace awareness' but the technology wasn't there to support them.[13]

Summary

Table 3 contains a summary of the major comments received from the interviews. In general, the comments depict a system that provides good capabilities, yet does not meet all the users needs, and is still in the process of maturing. These comments also show that the COP does address and is evolving to fulfill the C4IFTW concept established by the CJCS. This makes the implementation of the COP congruent with the requirements sources identified in Chapter 1.

Table 3. Summary of COP Comments

Favorable	Unfavorable
Present system is useful	System not as robust or timely as needed
Experienced users have a much more robust capability than average COP user	Training lags; Need a mission ready training program
Filters with right settings can present user the exact information needed	Problem getting theater CINCs to release COP to Services
Communication and display filters are pretty flexible	Glut of information that overloads users; Current information provided is overkill
Good access to intel and imagery data overlaid on ops data	Present COP data quality could be improved
COP supports C4I doctrine	Need programmable filters
	Not yet ready to be used as a weapons control platform
	Piecemeal technical solution… for an unbounded systems engineering experiment

Comparison with Historical and Doctrinal Criteria

Initially, the COP appears to meet both historical-based and doctrine-based criteria. However, to provide a more accurate assessment, the two sets of criteria were combined in an effort to form one comprehensive COP "report card." To assign a "grade," the interview responses and documented comments were translated from the narrative text into either "P" for pass, "F" for fail, "D" for "depends," or "-" if not evaluated or no translation was possible. These were summed up to provide a total score for the criteria, which also included "N" for neutral summation (e.g., two "F"s, two "P"s, and a "D" average to a grade of "N"). The results of this integration effort are included in Appendix C. Based on this attempt to quantify interview responses the COP received an overall grade of "P" for those areas scored. However, 21 percent of the scores were either "F"s or "D"s, and almost two-thirds of the total "report card" (including such areas as mobility,

survivability and sustainability) had no evaluation grade at all. This indicates there is room for improvement in both the GCCS COP and the evaluation process.

Notes

[1] MGen Timothy A. Kinnan, panel discussion during 1999 CSAF Aerospace Doctrine Symposium, Maxwell AFB, AL, 2 March 1999.

[2] Maj C. R. Young, HQ EUCOM, email correspondence to Lt Col Juan Moreno, 2 February 1999, used with permission of both Maj Young and Lt Col Moreno.

[3] Maj Robert W. "Bull" Lanham, Joint Staff J33, telephone interview by author, 28 Jan 1999.

[4] Lt Col Greg Main, ESC/DIAC COP Program Manager, interviewed by author via email, 1 February 1999.

[5] Wolcott D. Baird, interviewed by author via email, 29 January 1999.

[6] Lt Col Michael W. Lamb, interviewed by author via email, 21 January 1999.

[7] Lt Col Mark Devirgilio, interviewed by author via email, 21 January 1999.

[8] Lt Col Frank J. Caravella, US Army Retired, "Combined Air Operations in Bosnia," *Military Review*, vol 77, no 4 (July 1997), 88.

[9] 1Lt Michael K. Morrill, ACC/DIOOC, interviewed by author via email, 25 January 1999.

[10] Lamb.

[11] Devirgilio.

[12] Lanham.

[13] Morrill.

Chapter 6

Conclusions

> *The observer signals by radio all his observations, in general addressing himself to the Division report center…Infantry airplane observers should not send by radio any information of which they are not certain. Observations of this nature should be noted on the written message to be dropped at the report center, mentioning, of course, the fact that the information is of doubtful accuracy.*
>
> —Circular Number 1, HQ Chief of Air Service, 1st Army, 19 August 1918[1]

> *We have set the course with C4I For the Warrior concept. Many milestones have been achieved. The Global Command and Control System is well underway. We continue to make progress toward a common global vision to provide the Joint Armed Forces with the critical information they need.*
>
> —Gen John M. Shalikashvili, 12 June 1994[2]

We have come a long way, in a short time, from the days of dropping notes during the St. Mihiel offensive in WWI to the integrated, complex, more reliable C4 systems in place today. The GCCS COP, the latest "arrow rider" to appear on the battlefield, is the advocated single solution to the Joint warfighter's C4 requirements.

Technology is constantly improving, and the military must keep watch on innovations such as high-definition imaging and displays, parallel computer architectures, and data fusion to see how we can best leverage off both technology and the commercial sector.[3] Also, the Air Force, like the other Services, is migrating more to GCCS as the foundation for other applications, such as Theater Battle Management Core System (ATO

generation) and Joint Tactical Information System (enables data exchange at the tactical level).[4] With such promises in technology and systems integration, and with budget constraints in mind, one can only imagine what the "GCCS After Next" will look like.

This research effort concluded the GCCS COP is more *coup d' oeil* than confusion because of the useful capability it provides in theater. However, there are areas that must be addressed to enable effective use of the GCCS COP and fully meet the warfighter's needs. Therefore, the following recommendations are offered.

Recommendations

Establish doctrine and policy to ensure the CINC's information requirements are identified at the beginning of the planning process. Then the staff can tailor the system to have it automatically provide, or *push* the data to the CINC, instead of having to continually request or *pull* the data. The staff can also use appropriate filtering and fusing capabilities to automate information fusion and provide faster battlespace orientation. Both these concepts are supported by results of a study indicating that both automated pre-processing systems, and having the system push the data, shorten response time against incoming threats, while maintaining a higher level of accuracy.[5] Efforts such as the Doctrine Optimization Project, a project to generate a set of rules, or "doctrines" to optimize decision making in tactical scenarios, also indicate the viability of automated information fusion and decision support.[6]

Establish policy and guidance for C4 systems architecture at the Air Force level. Joint doctrine is very good at addressing C4 doctrine; however, Air Force C4 doctrine is almost non-existent. Just specifying CTAPS or TACS does not adequately capture the doctrine necessary for the infrastructure, employment, and use of a C4 system.[7] There

must also be corroboration with C2 doctrine experts to ensure congruence of capability and intent.

Establish procedures for, and allow release of, CINC-level COP information to supporting Service components not in theater. This would apply equally to component commands preparing forces for deployment into theater, any reach-back capability in the US necessary to support the AEF concept, and could even include C2 organizations purposefully kept out-of-theater to protect critical assets.[8] However, doctrine and policy would be needed to prevent the "Tuesday Luncheons" of Vietnam from reoccurring.

Ensure COP users receive initial and recurring training. The COP, and the CTP, have both tremendous potential and the capability to overwhelm a warfighter with seemingly meaningless information. Initial and recurring training can make the difference in enabling the warfighter to leverage the technology available.

Conduct additional assessments of the GCCS COP. Additional systematic or even continuous assessment of the COP will provide better insight into user needs and ensure all aspects of the system (e.g. mobility and sustainability) meet the warfighter's needs. The proposed "report card" could be used, providing both user assessment and specific comments addressing needs.

Areas Requiring Additional Study

Although limited in scope to the COP part of the GCCS, this research effort was not able to address all aspects of the COP given all potential situations. Therefore, the following areas are recommended for additional study:

- Use of GCCS COP in Coalition and Alliance forces

- Use of GCCS COP or COP-generated information with other US government agencies, non-governmental organizations (NGOs), international organizations (IOs), and private voluntary organizations (PVOs)
- Effectiveness of GCCS COP in MOOTW and other peace operations.
- Level of fusion, integration, and resulting usefulness of intelligence information in both the COP (operational level) and CTP (tactical level)
- GCCS COP capabilities and requirements needed to enable and support conflict termination and resolution
- Human factors assessment of GCCS COP-based operations center, and its affect on C2 effectiveness and efficiency
- Assessment of CINC and Joint Staff requirements for next generation GCCS COP capability

Conclusion

The GCCS COP does provide useful information and capability to the CINC, component commanders, and staff-level warfighters in theater. However, there are several areas, such as data quality, programmable filters, and better integration and interoperability of sensor information, that need to be addressed to enable the GCCS COP to better meet the warfighter's needs. All this must be done with the goal of unity of effort in mind,

> There is no one fusing of information that meets the needs of all warriors. However, with concise, accurate, timely, and relevant information, unity of effort is improved and uncertainty is reduced, enabling the force as a whole to exploit opportunities and fight smarter.[9]

Notes

[1] *The U.S. Air Service in World War I: Volume III, The Battle of St. Mihiel*, Compiled and edited by Maurer Maurer (Washington, DC: The Office of Air Force History, HQ USAF, 1979), 30-31.

[2] Quoted in *The Joint Doctrine Encyclopedia*, 75.

[3] Dr. John Blair, "Advanced Technology Challenges in the Defense Industry," In *The Future of Air Power in the Aftermath of the Gulf War*, Edited by Richard H. Shultz, Jr. and Robert L. Pfaltzgraff, Jr. (Second Printing, Maxwell AFB, AL: Air University Press, July 1997), 338.

[4] Secretary of the Air Force (Legislative Liaison), *1998 Air Force Congressional Issue Papers*, on-line Internet, 20 January 1999, available from http://www.af.mil/lib/afissues/1998/issue98.html

[5] Didier M. Perdu and Alexander H. Levis, "Evaluation of Expert Systems in Decision Making Organizations," in *Science of Command and Control: Part II Coping With Complexity*, edited by Stuart E. Johnson and Alexander H. Levis (Fairfax, VA: AFCEA International Press, 1989), 89.

[6] The Bradley Department of Electrical and Computer Engineering, "The Doctrine Optimization Project," (Blacksburg, VA: Virginia Polytechnic Institute and State University, 1998); on-line, Internet, 17 March 1999, available from http://armyant.ee.vt.edu/doctrine.html

[7] Thomas A. Cardwell III, *Airland Combat: An Organization for Joint Warfare* (Maxwell AFB, AL: Air University Press, December 1992), 116.

[8] Jeffery R. Barnett, *Future War: An Assessment of Aerospace Campaigns in 2010* (Maxwell AFB, AL: Air University Press, January 1996), 108-109.

[9] Joint Pub 6-0, *Doctrine for Command, Control, Communications, and Computers (C4) Systems Support to Joint Operations,* 30 May 1995, I-7.

Appendix A

Interview Results

In order to gather firsthand information, the following interview questions were sent by email to operational customers and users of the GCCS COP, program office personnel, and other personnel having experience with the system. Responses are included after each question, and additional comments generated as a result of the interviews are also included.

In a parallel effort at the Air War College, another set of interview questions concerning the COP was sent to perspective respondents. Those questions, and one set of responses, are included at the end of this appendix.

Questions and Responses

1. What is your type and level of experience with the GCCS/COP (e.g., experienced design engineer, novice user)?

   User, strategic level and tactical (JTF)[1]

   I've used it in the field and been involved with it's building for over 10 years…most of my perspectives are based on either my observations as a design agent, superimposed on my operational experience in another life (retired as Navel Intel officer 8 years ago, with tours as CJTF J2, with battle watch integrated with J3, and JIC production manager (several tours)), and my interpretation of today's users comments.[2]

   Volunteered in Jan 96 to be part of DISA field support team and spent 6 months in Europe supporting initial GCCS fielding. Then assigned as

COP Engineer in GCCS Engineering office until PCS in Oct 98. Now work at ESC/DIA, Global Awareness PAD as COP lead. So, short answer is I have about 2 yrs COP experience as part of development Agency (DISA), limited true operational experience, have supported several exercises and pretty familiar with it. Acted mostly as PM for Cop at DISA, INRI did actual development.[3]

Technical reviewer and interested engineer.[4]

We have not had the opportunity to use COP all that much due to constraints in releasing COP pictures by the CINCs (CENTCOM, PACOM). [5]

I'm a novice, and don't use it on a daily basis. In Sep 98, I did attend the 3 week GCCS COP operator's course taught by the Navy at Damn Neck, Virginia. Since then, I've spoke with people affiliated with COP here at Langley, CENTCOM, USAFE, and AIA. [6]

2. Does the system present the right information needed by the users (e.g., theater commanders/JFACC)?

[Info presentation] in need of refinement, often what info is needed may not be available or can not be provided due to system incompatibilities (e.g., battle damage imagery).[7]

Believe the answer to be yes, within the limitations of the functionality of the system. This would prob need to come from a user, but within the design constraints of the system, it does a pretty good job. [8]

Probably not a good question to be answered by the development community - probably better suited for operational users such as CENTCOM, USFK. But I will attempt an answer based upon what my experience had been. First part of answer is "it depends". It really depends upon what the mission of the particular user is, which I don't think can be over-emphasized. It also depends upon the data sources available to the user. Ability to interpret new data types is being incorporated all the time. AF will probably tell you it is not as robust and timely as they need it. Navy which has been using the COP in many forms (genesis of GCCS COP was Navy JMCIS system) for several years will probably be more positive of how well it's capabilities meet their needs. Army data is currently very weak almost to be non-existant and Army hasn't really made an effort that I have seen to embrace COP. Marines have some real interesting ideas and architectures on how they are planning to use COP. My personal opinion on this is that the COP does provide the right information needed by the warfighter to obtain situational awareness. It is not yet and may not be anytime soon be ready to be used as a weapons

control platform but the capabilities are constantly evolving and there are several efforts underway that will significantly enhance it's utility in this area such as real-time COE. Cop is also constantly being changed to incorporate additional data source interfaces, incorporation of Space Data (initiative in EFX 99 this year), upgrade to DII COE COP underpinning in DII COE 3.2 and higher, addition of Intelligence (access to MIDB data) and Imagery enhancements (I3 suite of applications), etc. I think it is also the only system now that can take data from all these various sources, integrate them on a single display and have the ability to distribute these tracks among other COP enabled (DII COE) platforms to build a "common" display. But the commonality is only as good as the architecture that you put in place. [9]

COP/CTP/COE are piecemeal technical solutions and standards for an unbounded system engineering experiment. [10]

The JTF commander has a battle staff requiring information from the common data set to be sliced & diced differently. The information must be split different ways to enable the battlefield function commanders (e.g., JGCC, JFACC, JMCC, JSOCC) to view the information and be able to work with it. Other access and format concerns include providing a Service component picture and access by Coalition forces. The present system is useful; however, it's not where it needs to be—it does not quite meet all the needs of the users. The goal is to increase the speed of decision making—render information on understanding the battlespace to the commander to allow him to be faster than his adversary. We will never have 100% certainty. We will always have a blind side.[11]

I haven't seen it in full operation, but from what we covered in the course, the answer is yes. [12]

3. Are system users presented with too much information, just enough information, not enough information?

At tactical level there is a glut of information that overloads users and may desensitize them.[13]

This is a function of proper plot control settings, doctrine, conops, and operational problem. [14]

I would probably approach this from a slightly different point of view and maybe ask "is the user presented with the correct quantity and QUALITY of information he needs to prosecute his mission (whatever that may be). Quality relates to issues such as timeliness (data latency), integration/correlation/fusion of similar info from different sources and things like that. Present COP data quality could be improved on.

Timeliness (latency) of data and it's propagation throughout the system could be improved. If data is not properly managed or filtered, operator can be easily overwhelmed. For instance, if when inputting ELINT data, proper filters are not set, display and machine may easily be overwhelmed with ELINT tracks. Those users that have spent a significant effort getting COP architectures defined and data sources and data flows defined (CENTCOM, USFK) have a much more robust capability than the average COP user.[15]

If making mission essential decisions is the criteria on how much info you need, then the current system idea are overkill. [16]

Concerning the level of information presented to the user—we're not designing a system to overwhelm the customer. We need to present information as needed, and this differs from person to person. Providing more raw data requires more people to fuse. The question is, how much do you fuse purely through automation prior to display? Until this is defined, we choose to error on the conservative side of providing too much information, allowing the customer to decide how to fuse.[17]

There are several ways to filter information, and with the right settings, users can be presented with exactly the information they need. [18]

4. What filters are available to enable the user to customize the type/amount of information that can be presented for decision making?

   We need programmable filters, besides existing ones. This will allow users to access only that info needed at that time. [19]

   Should be specified in the attachments [to the email]. It has both comms and display filters that are pretty flexible. [20]

   See attached info paper - it is still pretty accurate and talks about current versus coming COP features in GCCS - GCCS 3.0 is now fielded, so the references to GCCS 3.0 should now apply. It discusses COP filtering capabilities. There are basically two types of filtering, Input/Output data filtering and Display filtering. [21]

   Filters are really processes that allow tailoring of vertical information flows. These filters have names—commander's intent. The tricky part is to translate intent into a set of rules to filter info. A good staff can do this. [22]

   There are filters on what type of reports to accept, as well as what type (friendly/enemy, air/naval/land) of information to display.[23]

5. Were there any notable issues in fielding the COP (e.g., technical challenges, changes needed in operating procedures/doctrine, customer acceptance/transition/training?

> I think we need a "mission ready" training program to be sure all users in the field are fully capable. [24]
>
> Yes to all. Optimized for Navy near to non real time ops, does pretty well in most Air Force J3 type settings (again with constraints), and less well for ground. Good access to intel and imagery overlaid on ops data. [25]
>
> Yes. Training has always been an issue and lags behind the fielding. Also, GCCS and COP were developed by DISA originally, who are the technical developers, the Services are responsible to train users (organize, train, equip - title 10 stuff). Navy has been doing training on JMCIS for many years and has a leg up but other Services are lacking. Navy also has an AFSC for a COP (JMCIS) operator and therefore can incorporate into formal training pipeline. The other Services haven't gotten there yet. As COP was a relatively new capability there was really no CONOPS associated with it, it is still evolving. The Army is probably wrestling with CONOPS/Doctrinal issues more than the other Services. For instance, Army doctrine dictates something to the effect that troop positions and movements are only allowed to be transmitted up or down two levels of command. If they input troop positions into COP as tracks they will potentially be visible to any level of command and therefore possibly invite the top-down direction that their doctrine was specifically changed to avoid - Capt John Bayer, USA at DISA gave give you a much better explanation of that issue. Maj Lanham should be able to give you insight into what issues they are facing with developing CONOPS and COP reporting requirements. I think a major problem is that there is not a standard COP CONOPS as it varies substantially with your mission. Ie - AMC CONOPS will be significantly different than USFK CONOPS and STRATCOM will be nothing like the other two. Biggest technical challenge may be - how to get all the data sources desired by a particular CINC established and developing the specific COP architecture require to support that configuration. Then keeping it up and running with enough experienced users. [26]
>
> I don't think the users really know what they need or want. Thus the issues are minor as the system is used in a "test drive" mode. Real ops will be the ultimate test. [27]
>
> One of the biggest challenges we face is getting the Theater CINCs to release the picture to ACC. While preparing forces to deploy in contingencies, HQACC and deploying units need access to the COP to gain situational awareness. Access to the picture is critical prior to units/personnel deploying into theater. Another challenge the AF faces is

system administrator knowledge of what COP can provide. I think we're way behind the Navy (because of their years of development with JIMSYS) in fully utilizing COPs potential. Is anyone or any office in the AF really looking hard at COP and deciding what's the best way for us to utilize this information? Finally, someone from the AF side needs to standardize how the AF will report it's data (airbases, types of acft at the bases, etc.).[28]

6. Is technology for COP affecting (changing) C4I doctrine (in which areas), or is it following (supporting) C4I doctrine, and in what way?

   Doctrine has always lagged technology. We should focus more on the front end at acquisition. [29]

   In general, COP introduces doctrine for info management, at least in my opinion. Users would be best source. [30]

   Not right person to ask. Probably needs to be answered by Joint Staff or user (CINC). [31]

   Technology causes weak C2 doctrine. Focus is toward gizmos and stuff. Real focus should be at the JFC decision making level. This area demands systematic study and well engineered solutions. Current doctrine reflects C2 loss of focus. [32]

   Top level doctrine is flexible enough to accommodate the changes in technology. For example, the C4I For The Warrior vision remains the same. In general, the GCCS COP is a technology pull as opposed to a technology push.[33]

   Certainly technology is changing the way we do business, but the latest C4I doctrine discusses total "battlespace awareness". COP supports this doctrine, perhaps not perfectly yet, by graphically displaying various types of intel and operational data on one screen. I'm sure WWII commanders dreamed of "battlespace awareness" but the technology wasn't there to support them.[34]

7. What other observations, lessons learned, or feedback have you experienced or received concerning COP and operational doctrine/tactics (e.g., with respect to Joint Publications)?

   Until all services are on board we need better familiarization with each others systems and methods (i.e., how say Navy distributes comm/info within their task forces or Army from battalion to platoon). [35]

Recommend discuss with either Maj Lanham or Lt Col Caldwell on Joint Staff J3. [36]

The COP/CTP/COE words are tossed around with out much thought to how these notions help commanders make and communicate decisions. Recent 3-56 (JC2) meetings demonstrate this be explicit fact—where's the pub after "years" of work! [37]

I attended a conference at NORAD/SPACECOM and there was a Marine Lt Col there who said the AF was just scratching the surface when it came to COP. He'd grown up with JIMSYS and it's predecessors. Hopefully, many of these lessons learned have been captured in Navy/Marine doctrine, and Joint Doctrine, and could aid in your research.[38]

Additional Comments from the Interviews

Concerning the term and definition of "COP":

There are questions as to what COP is, such as: Is it situational awareness, or is it planning? [39]

The term COP was generally applied to a set of software within GCCS which allowed aggregation and display of tactical data feeds onto a common display (map) and provided some tools for it's distribution to other GCCS/JMCIS workstations…[it] has evolved over the past few years to be much broader yet more specific which causes many people confusion. "COP" now also defines an architecture and per "Joint Staff/J3 CJCSI 3151.02 (?), COP has a formal definition which defines it as specific to a CINC and the dataset he defines. All lower level are not "COPs" but "CTP"'s and feed the CINC COP, although all use the same Software tools. COP is often used very generically and most often mis-used, at least in light of formal JCS definition. For example…COP [is used] as a term to define a much broader Information Management function.[40]

Concerning GCCS COP requirements and overall system:

Our challenges include: Going to near real-time information fusion; Need to build a common tactical data set; Need to figure out how best to display the information; Passing tactical intel to COP[41]

Basically, today's GCCS COP is a combination of the GCCS correlation engine, a contact/track data distribution mechanism across SIPRNET, and the ability to access various support databases that are available in GCCS. The functionality is very dependent on a reliable LAN/WAN, trained operators, and a good command/theater architecture and established

> conops. Once these things are established, the system does a reasonable job of keeping track of high interest tracks, but does need a reasonable amount of attention by a qualified operator. My guess is that most of the disappointment observed by users is caused by one of three things: not trained; no process or doctrine; unrealistic expectations. It's certainly not perfect, but it does a reasonable job if set up and trained. I've participated in many operational COP management processes involving service and CINC reps, and one of the biggest problems is that only the Navy has an established operational process for this kind of functionality. The Joint Staff is pushing the creation of doctrine and processes, but progress is slow, and each command center and theater seems to have different infrastructures and processes…Senior commanders seem to want the functionality, and it's up to their staffs to create the requisite processes. Today's COP symbology is mostly NTDS, but we are implementing 2525 in the next generation.[42]

Parallel Survey Questions and Response

The following questions and answers were accomplished as part of an independent research effort at Air War College.[43] The person interviewed has experience with the GCCS COP system in EUCOM.

1. Are you all in fact using the COP in the above mentioned operation?

> Yes. We monitor the Bosnia Operational Picture or BOP occasionally in the European Theater Command Center (ETCC). We don't watch it all the time. It is a contingency tool which sits in the corner until some incident makes it relevant. This is not because the BOP isn't an excellent product. Our Joint Reconnaissance Center uses it a little more often to track Recce flights. The area in which COP is most useful to us today is Theater Ballistic Missile Warning and Defense, although not for the Bosnia Operation. We've built a large part of our Shared Early Warning architecture around the COP's TBMD segment. It is reliable when monitored closely.[44]

2. How useful is the system? Is it more than just a high tech "gee-whiz" toy to impress the visitors and feed the commander what he wants to see?

> The BOP is used much more extensively at the CAOC-Vicenza to monitor the air picture (along with ADSI) and to provide the order of battle. It is a good situational awareness tool. It has some useful features which aren't

> fully employed yet. The program is still growing in terms of system capability, system reliability, and user confidence and proficiency.[45]

3. How useful is it to him in making the strategic level decisions? Does he have to fight off any tendency to work on the small stuff in the operations presented? In other words, is the temptation to micro-manage a given tactical or operational level action a result of the ability to see it all?

> We've certainly resisted the micro-management temptation at this HQ. I believe the BOP is useful in decision making at Vicenza and possibly Sarajevo, but suggest you talk to someone down there.[46]

4. How does it play out in the region? Is it used fully to plan execute and monitor the operation?

> I think the planning capabilities of the COP/BOP haven't been exploited very well so far, but they are there. We do plot the ATO on the BOP and use it to verify aircraft during execution. That has been particularly useful to our Joint Reconnaissance Center guys.[47]

Notes

[1] Lt Col Michael W. Lamb, interviewed by author via email, 21 January 1999.
[2] Wolcott D. Baird, interviewed by author via email, 29 January 1999.
[3] Lt Col Greg Main, ESC/DIAC COP Program Manager, interviewed by author via email, 1 February 1999.
[4] Lt Col Mark Devirgilio, interviewed by author via email, 21 January 1999.
[5] Maj Douglas R. Putney, ACC/DOOC, interviewed by author via email, 21 January 1999.
[6] 1Lt Michael K. Morrill, ACC/DIOOC, interviewed by author via email, 25 January 1999.
[7] Lamb.
[8] Baird.
[9] Main.
[10] Devirgilio.
[11] Maj Robert W. “Bull” Lanham, Joint Staff J33, telephone interview by author, 28 Jan 1999.
[12] Morrill.
[13] Lamb.
[14] Baird.

Notes

[15] Main.
[16] Devirgilio.
[17] Lanham.
[18] Morrill.
[19] Lamb.
[20] Baird.
[21] Main.
[22] Devirgilio.
[23] Morrill.
[24] Lamb.
[25] Baird.
[26] Main.
[27] Devirgilio.
[28] Morrill.
[29] Lamb.
[30] Baird.
[31] Main.
[32] Devirgilio.
[33] Lanham.
[34] Morrill.
[35] Lamb.
[36] Baird.
[37] Devirgilio.
[38] Morrill.
[39] Lanham.
[40] Main.
[41] Lanham.
[42] Baird.
[43] Maj C. R. Young, HQ EUCOM, email correspondence to Lt Col Juan Moreno, 2 February 1999, used with permission of both Maj Young and Lt Col Moreno.
[44] Young.
[45] Young.
[46] Young.
[47] Young.

Appendix B

Additional Documented Comments

This appendix contains available additional documented comments concerning the GCCS COP.

Concerning the COP:

> "Lt Col Caldwell/Joint Staff J3 provided status of JS COPWG; stressing their requirements review process and feedback from the CINCs that the GCCS COP engine needed to be more automated and user friendly."[1]

Concerning the BCOP:

> "Experimentation started in August 1995 when the US Air Force Staff delivered to the CAOC a prototype information system called the Joint Forces Air Component Commander (JFACC) Situational Awareness System. This system provided the information platform CAOC leaders hoped would integrate intelligence, planning and operational functions and provide the BCOP. CAOC leaders believe BCOP functionality enhances air operations and could help synchronize air/ground operations if shared with the LCC… All services agree to the requirement for a joint common operational picture to support theater planning and operations, but few agree on the specific display information and applications necessary to perform the missions."[2]

> "The BCOP is based on a UNIX workstation whose data base uses standard Defense Mapping Agency map and spot imagery data for the area of responsibility (AOR)… Overlaid on [the] map/imagery background are computer-generated air tracks from the RAP. The ACC uses the RAP to command and control friendly air assets in a contingency. The system provides the ability to overlay all airspace control measures that might affect current air operations, such as air corridors and restricted operations zones. Real-time intelligence products, such as the Tactical Information

Broadcast Service and Tactical Related Applications, are fused into the system for immediate alerts, essential for safe air operations against any dynamic air defense threat."[3]

"To receive a real-time update on ground activity in a local or tactical area, video from Predator or Gnat UAVs or EP-3 surveillance aircraft was integrated into the BCOP and placed into a separate graphics box on top of the digital map… In any dynamic situation, air and ground operations officers could use the BCOP to assess a situation and clarify the facts. Data, in all forms, could be integrated on the screen from various sources. Air and ground options would be presented, resulting in shortened decision cycles and more effective use of scarce joint assets. Air and ground activities would be synchronized because the ACC and LCC would be working as one—battlefield effects should be synergistic."[4]

"Without reference information, J-STARS data was difficult to interpret…J-STARS data was never integrated into the BCOP but this objective is certainly achievable with continued software development."[5]

"All services agree that a COP should have a synergistic effect on the battlefield, denying the enemy a chance to react decisively or effectively."[6]

"Through the CAOC in Vicenza, the Air Force has proved that the information technology is available today to reach our joint goal of synchronized air and ground operations."[7]

Notes

[1] Common Operational Picture Technical Working Group (COP TWG), Meeting Minutes, 7 July 1998; on-line, Internet, 20 March 1999, available from http://dii-sw.ncr.disa.mil/coe/wg/cop/meetings/1998/0707_minutes.shtml

[2] Lt Col Frank J. Caravella, US Army Retired, "Combined Air Operations in Bosnia," *Military Review*, vol 77, no 4 (July 1997), 88.

[3] Caravella, 89.

[4] Caravella, 90.

[5] Caravella, 90-91.

[6] Caravella, 91.

[7] Caravella, 91.

Appendix C

Summary Report Card

Table 4. Derived Responses vs. Assessment Criteria

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6	Person 7	Person 8	Doc 1	Doc 2	**Total**
Unity of Effort (H, D)[a,b] Produce Unity of Effort (O)	-	-	-	-	-	-	-	-	-	P	**P**
Battlefield View (H)	F	P	P	-	-	P	P	P	-	P	**P**
Communications (H)	P	P	P	P	P	P	P	P	-	P	**P**
	-	-	-	-	-	-	-	-	-	-	**-**
Common Philosophy (D)	-	-	-	-	-	-	-	-	-	-	**-**
Operations Support	-	-	-	-	-	-	P	-	-	-	**P**
Exploit Total Force Capabilities (O)[c]	-	-	-	-	-	-	-	-	-	P	**P**
Flexible (P)[d]	-	P	P	-	-	P	-	P	-	P	**P**
Responsive (P)	F	P	-	-	-	P	-	P	F	P	**P**
Mobile (P)	-	-	-	-	-	-	-	-	-	-	**-**
Survivable (P)	-	-	-	-	-	-	-	-	-	-	**-**
Sustainable (P)	-	-	-	-	-	-	-	-	-	-	**-**
Accuracy (I)[e]	-	-	-	-	-	-	-	P	-	P	**P**
Relevance (I)	-	-	P	-	-	P	P	P	-	P	**P**
Timeliness (I)	-	-	D	-	-	P	D	P	-	P	**P**
Completeness (I)	F	P	D	-	-	P	-	P	-	P	**P**
Security (I)	-	-	-	-	-	-	-	-	-	-	**-**

Planning Support	-	-	-	-	-	-	-	-	-		-
Exploit Total Force Capabilities (O)	-	-	-	-	-	-	-	-	-	P	**P**
Flexible (P)	-	P	P	-	-	P	-	-	-	P	**P**
Responsive (P)	F	P	-	-	-	P	-	-	-	P	**P**
Mobile (P)	-	-	-	-	-	-	-	-	-	-	-
Survivable (P)	-	-	-	-	-	-	-	-	-	-	-
Sustainable (P)	-	-	-	-	-	-	-	-	-	-	-
Accuracy (I)	-	-	-	-	-	-	-	-	-	P	**P**
Relevance (I)	-	-	P	-	-	P	P	-	-	P	**P**
Timeliness (I)	-	-	D	-	-	P	D	-	-	P	**P**
Completeness (I)	F	P	D	-	-	P	-	-	-	P	**P**
Security (I)	-	-	-	-	-	-	-	-	-	-	-
Common Language (D)	-	-	-	-	-	-	-	-	-	-	-
Interoperability	-	-	-	-	-	-	-	-	-	-	-
Interoperable (P)	F	P	P	-	-	-	D	-	-	P	**P**
User Interface	-	-	-	-	-	-	-	-	-	-	-
Properly Position Critical Information (O)	F	P	P	F	-	P	D	P	-	P	**P**
Usability (I)	P	P	P	P	-	P	P	P	F	P	**P**
Brevity (I)	F	P	-	F	-	P	P	-	-	-	**P**
Common Purpose (D)	-	-	-	-	-	-	-	-	-	-	-
Unified Action	-	-	-	-	-	-	-	-	-	-	-
Disciplined (P)	-	-	-	-	-	-	-	-	-	-	-
Information Fusion	-	-	-	-	-	-	-	-	-	-	-
Information Fusion (O)	-	-	P	F	-	-	D	P	-	P	**P**

[a] Historical-Based Criteria
[b] Doctrine-Based Criteria
[c] C4 Systems Objectives
[d] C4 Principles
[e] Information Quality Criteria

Glossary

AAF	Army Air Force
AEF	Aerospace Expeditionary Force
AOR	Area of Responsibility
ATO	Air Tasking Order
BDA	Battle Damage Assessment
C2	Command and Control
C3	Command, Control and Communications
C4	Command, Control, Communications and Computers
C4I	Command, Control, Communications, Computers, and Intelligence
C4I2	Command, Control, Communications, Computers, Information, and Intelligence
C4IFTW	C4I For The Warrior
CAOC	Combined Air Operations Center
CENTCOM	Central Command
CINC	Commander In Chief
CJCSI	Chairman of the Joint Chiefs of Staff Instruction
COE	Common Operating Environment
CONOPS	Concept of Operations
COP	Common Operational Picture
COPWG	Common Operational Picture Working Group
CTAPS	Contingency Theater Automated Planning System
CTP	Common Tactical Picture
EUCOM	European Command
GCCS	Global Command and Control System
IO	International Organization
JFACC	Joint Forces Air Component Commander
JFC	Joint Forces Commander
JOC	Joint Operations Center
JOPES	Joint Operation Planning and Execution System
JTF	Joint Task Force
JV 2010	Joint Vision 2010

LAN	Local Area Network
MEA	Munitions Effects Assessment
MOOTW	Military Operations Other Than War
NATO	North Atlantic Treaty Organization
NCA	National Command Authority
NGO	Non-Governmental Organization
NIMA	National Imagery and Mapping Agency
NMS	National Military Strategy
NSC	National Security Council
NSS	National Security Strategy
PACOM	Pacific Command
PVO	Private Voluntary Organization
RMA	Revolution in Military Affairs
SPAWAR	Space and Naval Warfare Systems Command
STU-III	Secure Telephone Unit III
TACS	Tactical Air Control System
TADIL	Tactical Data Information Link
UHF	Ultra High Frequency
WAN	Wide Area Network
WW I	World-War I

Common Operating Environment (COE). The Defense Information Infrastructure (DII) COE was developed in late 1993. DII COE was designed to eliminate duplication of development (in areas such as mapping, track management, and communication interfaces) and eliminate design incompatibility among DoD systems. The purpose of DII COE is to field systems with increasing interoperability, reusability, portability, and operational capability, while reducing development time, technical obsolescence, training requirements, and life-cycle cost.[1]

Common Operational Picture (COP). The CINC's depiction of the battlespace for his AOR including current disposition of hostile, neutral, and friendly forces as they pertain to US and Allied Joint/Combined operations ranging from peacetime through crisis and war; and CINC generated overlays/projections (weather, battleplans, etc.).[2]

Common Tactical Picture (CTP). The current depiction of the battlespace for a single operation within a CINC's AOR including current, anticipated/projected, and planned disposition of hostile, neutral, and friendly forces and CINC generated

overlays/projections (weather, battleplans, etc.) as they pertain to US and Allied Joint/Combined operations ranging from peacetime through crisis and war.[3]

Global Command and Control System (GCCS). The GCCS is the mid-term implementation of the C4IFTW concept, which fulfills the requirement for a capability to move a US fighting force on the globe at anytime, and to provide it with the information and direction to complete its mission.[4]

Notes

[1] Software Engineering Institute, "Defense Information Infrastructure Common Operating Environment (DII COE)," (Software Technology Review Report), on-line Internet, 20 January 1999, available from http://www.sei.cum.edu/str/descriptions/diicoe_body.html

[2] *Commander's Common Tactical Picture Guide for GCCS 3.02, Draft Version 1.0*, 10 August 1998, 1.

[3] *Commander's Common Tactical Picture Guide*, 1.

[4] *Global Command and Control System*, on-line Internet, 20 January 1999, available from http://spider.osfl.disa.mil/fbsbook/fbsbook.html

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